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Please find below and/or attached an Office communication concerning this application or proceeding.

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Office Action Summary

Application No.

10/816,179

Applicant(s)

LEE ET AL.

Examiner

Rudy Zervigon

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on ____.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-24 and 26-49 is/are pending in the application.
- 4a) Of the above claim(s) 34-49 is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-24 and 26-33 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. ____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. ____. |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date <u>11/13/2006</u> . | 6) <input type="checkbox"/> Other: ____. |

DETAILED ACTION

Claim Rejections - 35 USC § 102/103

1. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.
2. Claims 1, 2, 5, 8-13, 15, 16, and 20-23 are rejected under 35 U.S.C. 102(e) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Moghadam, Farhad et al. (US 20030232495 A1). Moghadam teaches a system (All Figures; [0012], [0041]-[0044]) for depositing, the system (All Figures; [0012], [0041]-[0044]) comprising: a process module (Figure 1,2; [0050]-[0053]) including a processing chamber (210; Figure 2; [0049]) and a precursor gas system (Figure 2; [0059]) configured to deliver a gas-phase precursor (218, 219; Figure 2; [0059]) into the processing chamber (210; Figure 2; [0049]); a post-treatment module (Figure 1) for annealing (“furnace”; [0128]); a silane ([0126]) delivery system (218, 219; Figure 2; [0012], [0041]-[0044]) configured to deliver a vapor flow containing a silane ([0126]) precursor into the system (All Figures; [0012], [0041]-[0044]); and memory (234; [0059]-[0060]) and a processor (“CPU”, “memory”; [0059]-[0060]) in electrical communication with the process module (234; Figure 1,2; [0050]-[0053]), the post-treatment module (Figure 1) and the silane ([0126]) delivery system (218, 219; Figure 2; [0012], [0041]-[0044]), and instructions (Figure 3; “programming language”; [0060]-[0065]) stored on the memory (234; [0059]-[0060]) and executable by the processor (“CPU”, “memory”; [0059]-[0060]) to control the silane ([0126]) delivery system (218, 219; Figure 2; [0012], [0041]-[0044]) to deposit the silane ([0126]) precursor on the substrate for a first interval (“process step cycles”; [0131]) to form the first silane-containing layer, next to control the process module (Figure 1,2; [0050]-[0053]) to

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deposit the gas phase monomer on the first silane-containing layer for a second interval (“process step cycles”; [0131]) to form the low dielectric constant polymer layer ([0126]), and next to control the silane ([0126]) delivery system (218, 219; Figure 2; [0012], [0041]-[0044]) to deposit the silane ([0126]) precursor on the low dielectric constant polymer layer ([0126]) for a third interval (“process step cycles”; [0131]) to form the second silane-containing layer.

Applicant’s claim limitations of:

- a. “for depositing a composite polymer dielectric film on a substrate”
- b. “the composite polymer dielectric film including a low dielectric constant polymer layer disposed between and chemically bonded to a first silane-containing layer and a second silane-containing layer”
- c. “monomer delivery”
- d. “the composite polymer dielectric film”
- e. “for deposition of the low dielectric constant polymer layer”
- f. “for annealing the composite polymer dielectric film”
- g. “for forming the first silane-containing layer and the second silane-containing layer”
- h. “to form the first silane-containing layer”
- i. “gas phase monomer”
- j. “first adhesion promoter layer”
- k. “low dielectric constant polymer layer”
- l. “second silane-containing layer”

are all claim limitations of intended use of the pending apparatus claims. Further, it has been held that claim language that simply specifies an intended use or field of use for the invention

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generally will not limit the scope of a claim (Walter , 618 F.2d at 769, 205 USPQ at 409; MPEP 2106). Additionally, in apparatus claims, intended use must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim (In re Casey, 152 USPQ 235 (CCPA 1967); In re Otto , 136 USPQ 458, 459 (CCPA 1963); MPEP 2111.02).

Moghadam further teaches:

- i. The system (All Figures; [0012], [0041]-[0044]) of claim 1, wherein the silane ([0126]) delivery system (218, 219; Figure 2; [0012], [0041]-[0044]) is configured to deliver the silane ([0126]) precursor to a silane deposition module (210; Figure 2; [0049]) that includes a silane ([0126]) deposition chamber (210; Figure 2; [0049]) and a free-radical generating energy source (228; Figure 2; [0057]), and wherein the instructions (Figure 3; “programming language”; [0060]-[0065]) are executable by the processor (“CPU”, “memory”; [0059]-[0060]) to control an exposure of the silane ([0126]) precursor to energy from the energy source to form free radicals in the silane ([0126]) precursor after depositing the silane ([0126]) precursor on the substrate for the first interval (“process step cycles”; [0131]), as claimed by claim 1. Applicant’s claim requirement of “on the substrate for the first interval (“process step cycles”; [0131])” is a claim requirement of intended use. See above.
- ii. The system (All Figures; [0012], [0041]-[0044]) of claim 2, wherein the free-radical generating energy source (228; Figure 2; [0057]) is a plasma source, as claimed by claim 5
- iii. The system (All Figures; [0012], [0041]-[0044]) of claim 1, wherein the post-treatment module (Figure 1) includes a heater (36; Figure 1; [0023], [0024]) for heating the substrate, and

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wherein the instructions (Figure 3; “programming language”; [0060]-[0065]) are executable by the processor (“CPU”, “memory”; [0059]-[0060]) to anneal the composite dielectric layer in a presence of hydrogen in the post-treatment module (Figure 1) via the heater (36; Figure 1; [0023], [0024]) after depositing the silane ([0126]) precursor on the low dielectric constant polymer layer ([0126]) for the third interval (“process step cycles”; [0131]), as claimed by claim 8. Applicant’s claim requirements of “in a presence of hydrogen in .. after depositing the silane ([0126]) precursor on the low dielectric constant polymer layer ([0126]) for the third interval (“process step cycles”; [0131])” is a claim requirement of intended use. See above.

iv. The system (All Figures; [0012], [0041]-[0044]) of claim 8, wherein the heater (36; Figure 1; [0023], [0024]) is a hot plate, as claimed by claim 9

v. The system (All Figures; [0012], [0041]-[0044]) of claim 8, wherein the instructions (Figure 3; “programming language”; [0060]-[0065]) are executable by the processor (“CPU”, “memory”; [0059]-[0060]) to anneal the composite dielectric layer in a presence of 3-10% ([0037]) H₂ in He, as claimed by claim 11. Applicant’s claim requirement of hydrogen and helium gas identities is a claim requirement of intended use. See above.

vi. The system (All Figures; [0012], [0041]-[0044]) of claim 8, wherein the instructions (Figure 3; “programming language”; [0060]-[0065]) are executable to anneal the composite dielectric layer at a temperature of between approximately 250 and 450 degrees Celsius ([0037]), as claimed by claim 11

vii. The system (All Figures; [0012], [0041]-[0044]) of claim 8, wherein the instructions (Figure 3; “programming language”; [0060]-[0065]) are executable to anneal the composite

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dielectric layer for a duration of between approximately 2 and 10 minutes ([0037]), as claimed by claim 12

viii. The system (All Figures; [0012], [0041]-[0044]) of claim 1, wherein the process module (Figure 1,2; [0050]-[0053]) includes a cooled (“Many methods are well known to those of ordinary skill in the art for flowing a cooling liquid through a chuck”; [0024], [0070]) substrate holder (212; Figure 2), and wherein the instructions (Figure 3; “programming language”; [0060]-[0065]) are executable to hold the substrate at a temperature below the crystallization temperature of low dielectric constant polymer layer ([0126]) while depositing the gas phase monomer, as claimed by claim 13. Applicant’s claim requirements of “below the crystallization temperature of low dielectric constant polymer layer ([0126]) while depositing the gas phase monomer” are claim requirements of intended use of the pending apparatus claims.

ix. The system (All Figures; [0012], [0041]-[0044]) of claim 13, wherein the cooled (“Many methods are well known to those of ordinary skill in the art for flowing a cooling liquid through a chuck”; [0024], [0070]) substrate holder (212; Figure 2) is an electrostatic chuck ([0024]), as claimed by claim 15

x. The system (All Figures; [0012], [0041]-[0044]) of claim 15, the chuck having a surface, wherein up to 10 psi of helium is disposed between the substrate and the surface of the chuck during substrate cooling to aid in cooling the substrate, as claimed by claim 16 – Applicant’s claim requirement of “wherein up to 10 psi of helium” is a claim requirement of intended use. See Above.

xi. The system (All Figures; [0012], [0041]-[0044]) of claim 1, wherein the first silane-containing layer is a first adhesion promoter layer configured to chemically bond to an

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underlying silicon-containing layer, as claimed by claim 20. Applicant's claim requirements are claim requirements of intended use of the pending apparatus claims. See above.

xii. The system (All Figures; [0012], [0041]-[0044]) of claim 1, wherein the second silane-containing layer is a hard mask layer, as claimed by claim 21. Applicant's claim requirements are claim requirements of intended use of the pending apparatus claims. See above.

xiii. The system (All Figures; [0012], [0041]-[0044]) of claim 1, wherein the second silane-containing layer is an etch stop layer, as claimed by claim 22. Applicant's claim requirements are claim requirements of intended use of the pending apparatus claims. See above.

xiv. The system (All Figures; [0012], [0041]-[0044]) of claim 1, wherein the second silane-containing layer is a second adhesion promoter layer configured to chemically bond to an overlying silicon-containing layer, as claimed by claim 23. Applicant's claim requirements are claim requirements of intended use of the pending apparatus claims. See above.

It is not clear if Moghadam's program control (Figure 3; "programming language"; [0060]-[0065]) anticipates Applicant's functional limitations for his controller:

"deposit the gas phase monomer on the first adhesion promoter layer for a second interval ("process step cycles"; [0131]) to form the low dielectric constant polymer layer ([0126]), and deposit the silane ([0126]) precursor on the low dielectric constant polymer layer ([0126]) for a third interval ("process step cycles"; [0131]) to form the second silane-containing layer"

However, Moghadam's program control is taught as being operable in a cyclic method ("multiple process step cycles"; [0131]) implying "intervals" as claimed.

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In the event that Moghadam is not deemed to anticipate the claimed invention, as described above, it would have been obvious to one of ordinary skill in that art at the time the invention was made for Moghadam to conduct “interval” depositions.

Motivation for Moghadam to conduct “interval” depositions is for despoiting plural films as taught by Moghadam ([0131]).

Claim Rejections - 35 USC § 103

3. Claims 3, 4, 6, 7, 14, 17, 18, 19, 29, 30, and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Moghadam, Farhad et al. (US 20030232495 A1) in view of Noble; David B. et al. (US 6450116 B1). Moghadam is dicussed above. Moghadam does not teach:

- i. The system (All Figures; [0012], [0041]-[0044]) of claim 2, wherein the free-radical generating energy source (228; Figure 2; [0057]) is a UV light source, as claimed by claim 3
- ii. The system (All Figures; [0012], [0041]-[0044]) of claim 2, wherein the free-radical generating energy source (228; Figure 2; [0057]) is a thermal energy source, as claimed by claim 4
- iii. The system (All Figures; [0012], [0041]-[0044]) of claim 1, wherein the silane ([0126]) delivery system (218, 219; Figure 2; [0012], [0041]-[0044]) is configured to deliver the silane ([0126]) precursor to the process module (Figure 1,2; [0050]-[0053]), as claimed by claim 6
- iv. The system (All Figures; [0012], [0041]-[0044]) of claim 1, wherein the silane ([0126]) delivery system (218, 219; Figure 2; [0012], [0041]-[0044]) is configured to deliver the silane ([0126]) precursor to the post-treatment module (Figure 1), as claimed by claim 7
- v. The system (All Figures; [0012], [0041]-[0044]) of claim 13, wherein the instructions (Figure 3; “programming langauge”; [0060]-[0065]) are executable to hold the substrate at a

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temperature of between approximately -25 and -55 degrees Celsius while depositing the gas phase monomer, as claimed by claim 14

- vi. The system (All Figures; [0012], [0041]-[0044]) of claim 1, wherein the instructions (Figure 3; "programming language"; [0060]-[0065]) are executable to hold the substrate at a temperature of approximately 25 degrees Celsius or below when depositing the silane ([0126]) precursor, as claimed by claim 17
- vii. The system (All Figures; [0012], [0041]-[0044]) of claim 1, wherein the post-treatment module (Figure 1) includes an annealing chamber (100; Figure 1), a vacuum pump system, a mass flow controller, and at least one valve controlling a flow of gas into the annealing chamber (100; Figure 1), and wherein the instructions (Figure 3; "programming language"; [0060]-[0065]) are executable to hold an atmosphere within the annealing chamber (100; Figure 1) at a pressure of between approximately 1 and 10 Torr via the vacuum pump and the valve, as claimed by claim 18
- viii. The system (All Figures; [0012], [0041]-[0044]) of claim 1, wherein the post-treatment module (Figure 1) includes a substrate elevator and a plurality of heating elements for batch substrate processing, as claimed by claim 19
- ix. The system (All Figures; [0012], [0041]-[0044]) of claim 24, wherein the reactor is configured to generate a diradical monomer from the precursor, as claimed by claim 29
- x. The system (All Figures; [0012], [0041]-[0044]) of claim 29, wherein the monomer delivery system includes a vapor flow controller disposed between the vessel and the reactor, as claimed by claim 30

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- xi. The system (All Figures; [0012], [0041]-[0044]) of claim 24, wherein the post-treatment module (Figure 1) includes a hot plate for heating the substrate during annealing (“furnace”; [0128]), as claimed by claim 32
- xii. The system (All Figures; [0012], [0041]-[0044]) of claim 24, further comprising a first load lock and a second load lock coupled to the transfer module (Figure 8), wherein the first load lock is configured to accept insertion of a substrate into the system (All Figures; [0012], [0041]-[0044]), and wherein the second load lock is configured to permit removal of a substrate from the system (All Figures; [0012], [0041]-[0044]), as claimed by claim 33

Noble teaches an annealing chamber (200; Figure 3A) including

- i. The system (Figure 3A; column 6, line 51 - column 7, line 60) of claim 2, wherein the free-radical generating energy source (219; Figure 3A,4) is a thermal energy source, as claimed by claim 4
- ii. The system (Figure 3A; column 6, line 51 - column 7, line 60) of claim 1, wherein the post-treatment module (Figure 1) includes an annealing chamber (100; Figure 1), a vacuum pump system (not shown; column 7, lines 50-53), a mass flow controller (425; Figure 3A), and at least one valve (314, 317, 316; Figure 3A) controlling a flow of gas into the annealing chamber (100; Figure 1), and wherein the instructions (Figure 3; “programming language”; [0060]-[0065]) are executable to hold an atmosphere within the annealing chamber (100; Figure 1) at a pressure of between approximately 1 and 10 Torr (column 3; lines 45-48) via the vacuum pump and the valve, as claimed by claim 18
- iii. The system (Figure 3A; column 6, line 51 - column 7, line 60) of claim 24, wherein the monomer delivery system includes a vessel (“gas source”; Figure 3A) configured to hold a

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precursor to the gas-phase diradical, and a reactor (300 “plasma applicator”; Figure 1,4) configured to generate the diradical from the precursor, as claimed by claim 29 – Applicant’s claim requirements of “monomer delivery system includes a vessel configured to hold a precursor to the gas-phase diradical, and a reactor configured to generate the diradical from the precursor” is a claim requirement of intended use. See above.

iv. The system (Figure 3A; column 6, line 51 - column 7, line 60) of claim 29, wherein the monomer delivery system includes a vapor flow controller (360 Figure 3A,5) disposed between the vessel (Figure 4) and the reactor (200), as claimed by claim 30

v. The system (Figure 3A; column 6, line 51 - column 7, line 60) of claim 24, further comprising a first load lock (claim 5) to the transfer module (claim 5), wherein the first load lock is configured to accept insertion of a substrate into the system (Figure 3A; column 6, line 51 - column 7, line 60) - claim 33

It would have been obvious to one of ordinary skill in that art at the time the invention was made to add Noble’s system (Figure 3A; column 6, line 51 - column 7, line 60) to Moghadam’s apparatus including optimizing the substrate temperature controller and delivering process precursor to Moghadam’s process module and post-treatment module.

Motivation to add Noble’s system (Figure 3A; column 6, line 51 - column 7, line 60) to Moghadam’s apparatus including optimizing the substrate temperature controller and delivering process precursor to Moghadam’s process module and post-treatment module is for dopant diffusion control as taught by Noble (column 1; lines 50-56)

4. Claims 3, 19, 24, 26-28, 31 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Moghadam, Farhad et al. (US 20030232495 A1) and Noble; David B. et al.

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(US 6450116 B1) in view of Shinriki; Hiroshi et al. (US 6806211 B2). Moghadam and Noble are discussed above. Moghadam further teaches a system (All Figures; [0012], [0041]-[0044]) for depositing a composite polymer dielectric film on a substrate, the composite polymer dielectric film including a low dielectric constant polymer layer ([0126]), the system (All Figures; [0012], [0041]-[0044]) comprising: a process module (Figure 1,2; [0050]-[0053]) for forming the low dielectric constant polymer layer ([0126]), wherein the process module (Figure 1,2; [0050]-[0053]) includes a deposition chamber (210; Figure 2; [0049]) and a substrate holder (212; Figure 2) configured to hold and cool ("Many methods are well known to those of ordinary skill in the art for flowing a cooling liquid through a chuck"; [0024], [0070]) a substrate during a deposition process; a post-treatment module (Figure 1) for annealing ("furnace"; [0128]) the composite polymer dielectric film, wherein the post-treatment module (Figure 1) includes a heat source ([0009]) for heating the substrate and processing gas delivery system (All Figures; [0012], [0041]-[0044]) for delivering a reducing gas to the post-treatment module (Figure 1); a silane deposition module (210; Figure 2; [0049]) for depositing, wherein the silane deposition module (210; Figure 2; [0049]) includes a silane ([0126]) deposition chamber (210; Figure 2; [0049]) and a silane ([0126]) delivery system (218, 219; Figure 2; [0012], [0041]-[0044]) for delivering a silane ([0126]) precursor to the silane ([0126]) deposition chamber (210; Figure 2; [0049]); and a transfer module (Figure 8) disposed between the process module (Figure 1,2; [0050]-[0053]), the silane deposition module (210; Figure 2; [0049]) and the post-treatment module (Figure 1), wherein the transfer module (Figure 8) includes a substrate transport mechanism for transferring a substrate between the process module (Figure 1,2; [0050]-[0053]) and the post-treatment module (Figure 1); memory ("...computer program 410." "...memory system of the computer."

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[0059]-[0060]) and a processor (238; [0059]-[0060]) in electrical communication with the process module (234; Figure 1,2; [0050]-[0053]), the post-treatment module (Figure 1,2; [0050]-[0053]) and the silane ([0126]) delivery systems (218, 219; Figure 2; [0012], [0041]-[0044]); and instructions (“...computer program 410.” [0059]-[0060]) stored on the memory (“...computer program 410.” “...memory system of the computer.” [0059]-[0060]) and executable by the processor (238; [0059]-[0060]) to hold the substrate at a temperature of at least as low as -25 degrees Celsius ([0056] – “During deposition, the substrate is maintained at a temperature between about -20°C and about 500°C”) - claim 24

Applicant's claim requirements of:

- a. “first adhesion promoter layer and an overlayer, wherein the overlayer includes at least one layer selected from the group consisting of a second adhesion promoter layer, an etch stop layer and a hard mask layer, wherein the first adhesion promoter layer includes reactive silane ([0126]) groups configured to chemically bond to a silicon-containing layer that is in contact with the adhesion promoter layer”
- b. “for delivering a gas-phase diradical monomer to the deposition chamber”
- c. “a monomer delivery system”
- d. “the first adhesion promoter layer and the overlayer”
- e. “while depositing the gas phase monomer”

are claim requirements of intended use of the pending apparatus claims. See above.

Moghadam further teaches:

- i. The system (All Figures; [0012], [0041]-[0044]) of claim 24, wherein the substrate holder (212; Figure 2) includes a cool (“Many methods are well known to those of ordinary skill in the

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art for flowing a cooling liquid through a chuck”; [0024], [0070])ing mechanism configured to cool (“Many methods are well known to those of ordinary skill in the art for flowing a cooling liquid through a chuck”; [0024], [0070]) the substrate when the substrate is in the holder (212; Figure 2), as claimed by claim 27

ii. The system (All Figures; [0012], [0041]-[0044]) of claim 27, wherein the substrate holder (212; Figure 2) is an electrostatic chuck ([0024]) configured to allow a pressure of 10 psi or less of helium to be held between the chuck and the substrate to aid in cooling (“Many methods are well known to those of ordinary skill in the art for flowing a cooling liquid through a chuck”; [0024], [0070]) the substrate, as claimed by claim 28

iii. The system (All Figures; [0012], [0041]-[0044]) of claim 24, wherein the silane ([0126]) delivery system (218, 219; Figure 2; [0012], [0041]-[0044]) includes an inert gas ([0067]) supply, a mass flow controller [0066], and a silane ([0126]) vessel for containing and heating a volume of a silane ([0126]) precursor, as claimed by claim 31

The system (All Figures; [0012], [0041]-[0044]) of claim 24, wherein the post-treatment module (Figure 1) includes a hot plate (36; Figure 1; [0023], [0024]) for heating the substrate during annealing (“furnace”; [0128]), as claimed by claim 32

Moghadam does not teach:

- i. a monomer delivery system (All Figures; [0012], [0041]-[0044]) comprising a polymer film precursor source (219; Figure 2;) in communication with the deposition chamber (210; Figure 2; [0049]) and a reactor positioned between and in communication with the precursor source (219; Figure 2;) and the deposition chamber (210; Figure 2; [0049]) – claim 24

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- ii. The system (All Figures; [0012], [0041]-[0044]) of claim 24, wherein the instructions (“...computer program 410.” [0059]-[0060]) executable by the processor (238; [0059]-[0060]) to hold the substrate at a temperature of between –30 and –50 degrees Celcius ([0056] – “During deposition, the substrate is maintained at a temperature between about –20°C and about 500°C”) - claim 26. Applicant’s claim requirement of “while depositing the gas phase monomer” is a claim requirement of intended use of the pending apparatus claims. Further, it has been held that claim language that simply specifies an intended use or field of use for the invention generally will not limit the scope of a claim (Walter , 618 F.2d at 769, 205 USPQ at 409; MPEP 2106). Additionally, in apparatus claims, intended use must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim (In re Casey, 152 USPQ 235 (CCPA 1967); In re Otto , 136 USPQ 458, 459 (CCPA 1963); MPEP2111.02).

Moghadam, and Noble are discussed above. Moghadam, and Noble do not teach:

- i. The system of claim 2, wherein the free-radical generating energy source is a UV light source, as claimed by claim 3
- ii. The system of claim 1, wherein the post-treatment module includes a substrate elevator and a plurality of heating elements for batch substrate processing, as claimed by claim 19

Shinriki teaches an annealing chamber (Figure 17) including a UV source and a post-treatment module (200; Figure 19) with a substrate elevator (203).

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It would have been obvious to one of ordinary skill in that art at the time the invention was made to add Shinriki's post-treatment module (200; Figure 19) with a substrate elevator (203) and annealing chamber (Figure 17) including a UV source to the Moghadam and Noble apparatus, inclusive, for Moghadam to use a polymer gas in Moghadam's gas source (219; Figure 2). Further it would have been obvious to one of ordinary skill in that art at the time the invention was made to optimize Moghadam's instructions ("...computer program 410." [0059]-[0060]) to hold the substrate at a temperature of between -30 and -50 degrees Celcius ([0056] - "During deposition, the substrate is maintained at a temperature between about -20°C and about 500°C"). Motivation to add Shinriki's post-treatment module (200; Figure 19) with a substrate elevator (203) and annealing chamber (Figure 17) including a UV source to the Moghadam and Noble apparatus, inclusive, for Moghadam to use a polymer gas in Moghadam's gas source (219; Figure 2) is for preventing a plasma damage as taught by Shinriki (column 1, lines 63-67), and to produce polymeric low-k films by CVD as taught by Moghadam ([0237], [0006]).

Further, it would be obvious to those of ordinary skill in the art to optimize the operation of the claimed invention (In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980); In re Hoeschele, 406 F.2d 1403, 160 USPQ 809 (CCPA 1969); Merck & Co. Inc. v. Biocraft Laboratories Inc., 874 F.2d 804, 10 USPQ2d 1843 (Fed. Cir.), cert. denied, 493 U.S. 975 (1989); In re Kulling, 897 F.2d 1147, 14 USPQ2d 1056 (Fed. Cir. 1990), MPEP 2144.05).

Response to Arguments

5. Applicant's arguments filed November 13, 2006 have been fully considered but they are not persuasive.

6. Applicant states:

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“

Applicants respectfully traverse this assertion. This element of claim 1 is functional descriptive material under MPEP § 2106 in that it states an order of the first, second and third intervals recited in claim 1.

“

In response, the Examiner disagrees. The Examiner's specific above-recited elements are not believed to be functional descriptive.

Specifically, the Examiner cites the below claim elements, among others (see above), as claim limitations which are believed to be *nonfunctional* descriptive material:

- a. “for depositing a composite polymer dielectric film on a substrate”
- b. “the composite polymer dielectric film including a low dielectric constant polymer layer disposed between and chemically bonded to a first silane-containing layer and a second silane-containing layer”
- c. “monomer delivery”
- d. “the composite polymer dielectric film”
- e. “for deposition of the low dielectric constant polymer layer”
- f. “for annealing the composite polymer dielectric film”
- g. “for forming the first silane-containing layer and the second silane-containing layer”
- h. “to form the first silane-containing layer”
- i. “gas phase monomer”
- j. “first adhesion promoter layer”
- k. “low dielectric constant polymer layer”

1. “second silane-containing layer”

According to MPEP § 2106.01:

“

“functional descriptive material” consists of data structures and computer programs which impart functionality when employed as a computer component. (The definition of “data structure” is “a physical or logical relationship among data elements, designed to support specific data manipulation functions.”

“

As a result, the Examiner believes the above-recited elements, among other elements (see above), are nonfunctional descriptive material because the recited elements are *not* “data structures and computer programs which impart functionality” and is analogous to, for example, music, literary works, and a compilation or mere arrangement of data.

On the other hand, the Examiner has identified functional descriptive material as part of Applicant’s claimed “memory” and “processor” claim requirements. For example, the Examiner has recognized Moghadam’s equivalents for Applicant’s amended functional descriptive claim requirements of “...memory (“...computer program 410.” “...memory system of the computer.” [0059]-[0060]) and a processor (238; [0059]-[0060]) ...; and instructions (“...computer program 410.” [0059]-[0060]) stored on the memory (“...computer program 410.” “...memory system of the computer.” [0059]-[0060]) and executable by the processor (238; [0059]-[0060]) to hold the substrate at a temperature of at least as low as -25 degrees Celsius ([0056] – “During deposition, the substrate is maintained at a temperature between about -20°C and about 500°C”)”. As a result, the Examiner has identified Applicant’s above functional descriptive material which are

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analogous to “data structures and computer programs which impart functionality when employed as a computer component” as required by MPEP § 2106.01.

Applicant states:

“

In the Office action at page 7, section xiv, it is asserted that Moghadam teaches that its program control as operable in a cyclic method at paragraph [0131]. However, contrary to this assertion, paragraph [0131] goes on to state that the multiple process step cycles are cycles of thermal deposition and e-beam treatment processes. Therefore, this paragraph teaches only that the entire process of Moghadam may be repeated, and does not teach controlling a silane delivery system to deposit the silane precursor on the substrate for a first interval to form the first silane-containing layer, next controlling the process module to deposit the gas phase monomer on the first silane-containing layer for a second interval to form the low dielectric constant..

“

and...

“

In contrast, claim 1 as amended recites instructions executable to deposit a silane precursor on the substrate for a first interval to form the first silane-containing layer, next to deposit a gas phase monomer on the first adhesion promoter layer for a second interval to form a low dielectric constant polymer layer, and next to control a silane delivery system to deposit the silane precursor on the low dielectric constant polymer layer for a third interval to form a second silane-containing layer. The recited apparatus of claim 1 therefore forms a composite film with discrete layers of different compositions, rather than multiple layers of a single composition.

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“

In response, as stated above, Applicant's "gas phase monomer" is nonfunctional descriptive material. However, Moghadam does discuss, for example, utilizing "PGPE" monomer during processing [0184] among other monomers ("propylene glycol monopropyl ether" – "Comparative Example 1"). Further, Moghadam's repetitive processing ("process step cycles"; [0131]) to form the claimed low dielectric constant polymer layer ([0126]) is taught as described above and, when consider the reference as a whole, suggests Applicant's. Because the examiner has provided a rationale tending to show that the claimed product appears to be the same or similar to that of the prior art, although produced by a different process, the burden shifts to applicant to come forward with evidence establishing an unobvious difference between the claimed product and the prior art product. In re Marosi, 710 F.2d 798, 802, 218 USPQ 289, 292 (Fed. Cir. 1983). Refer to MPEP 2113.

Applicant states:

“

The modification of Moghadam to deposit the organo-silicon-based compound and the hydrocarbon at different times to form discrete layers of different compositions may result in the loss of the cross-linkage of the organo-silicon-based material in the Moghadam film, as the cross-linking hydrocarbon would be contained in a ...

“

In response, the Examiner is not proposing any such "modification" of Moghadam as described above. The Examiner has identified Moghadam's requisite materials and even the final product of low-k dielectric films as claimed by Applicants. Further, when taken as whole, the Examiner

believes Mogahadam's low-k dielectric films ([0126]) are produced in substantially the same manner to produce substantially the same result of low-k dielectric films. Because the examiner has provided a rationale tending to show that the claimed product appears to be the same or similar to that of the prior art, although produced by a different process, the burden shifts to applicant to come forward with evidence establishing an unobvious difference between the claimed product and the prior art product. In re Marosi, 710 F.2d 798, 802, 218 USPQ 289, 292 (Fed. Cir. 1983). Refer to MPEP 2113.

The remainder of Applicant's arguments, pages 6 and 7, are directed to the claim amendments filed November 13, 2006. The Examiner directs the reader to the above new grounds of rejection as necessitated by Applicant's claim amendments.

Conclusion

7. Applicant's amendment necessitated the new grounds of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

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8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner Rudy Zervigon whose telephone number is (571) 272-1442. The examiner can normally be reached on a Monday through Thursday schedule from 8am through 7pm. The official fax phone number for the 1763 art unit is (571) 273-8300. Any Inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Chemical and Materials Engineering art unit receptionist at (571) 272-1700. If the examiner can not be reached please contact the examiner's supervisor, Parviz Hassanzadeh, at (571) 272-1435.



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